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TOPOLOGY OPTIMIZATION OF ACTIVE TRANSPORT FLOWS

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Abstract. Fluid flows with particle transport are common in many industrial processes and components. The design of components for addition or removal of particles as well as mixing or stratification is of great importance in the specific processes. This work presents a methodology to apply topology optimization to the design of multiphase flow components. The work is a natural extension of the density based topology optimization procedure applied to design of passive mixers¹ and coolers² where the transported matter is not influencing the properties of the governing fluid flow model. In this work the effective properties of the fluid is changing with concentration.

In this work a multiphase fluid flow model³ is combined with a Brinkman penalization in order to introduce the design of the fluid component. Gradient based optimization is applied in order to optimize the performance of flow components. The paper present the design and optimization of a particle separator and the important interpolation for modeling both solids, fluids and particles with a monolithic problem formulation. The interplay with the physics behind the model are discussed and the influence of parameters are demonstrated.

Keywords: Topology Optimization, Multiphase flow, Particles, FEM

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